



POSSIBLE CAUSES OF PM_{2.5} AT THE IRMO SAMPLING STATION

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Irmo PM_{2.5} Stakeholders

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AGENDA

- What is the PM_{2.5} standard?
- What is the current reading at the Irmo station?
- What are the Columbia Area Design Value Trends?
- Why do speciation sampling?
- Where does DHEC conduct speciation sampling?
- What are the major components of PM_{2.5} in South Carolina?
- Where do the major components of PM_{2.5} come from?
- What can be done with speciation sampling?
- What are the possible sources of PM_{2.5} at the Irmo sampling station?
- Is speciation sampling coming to Irmo?



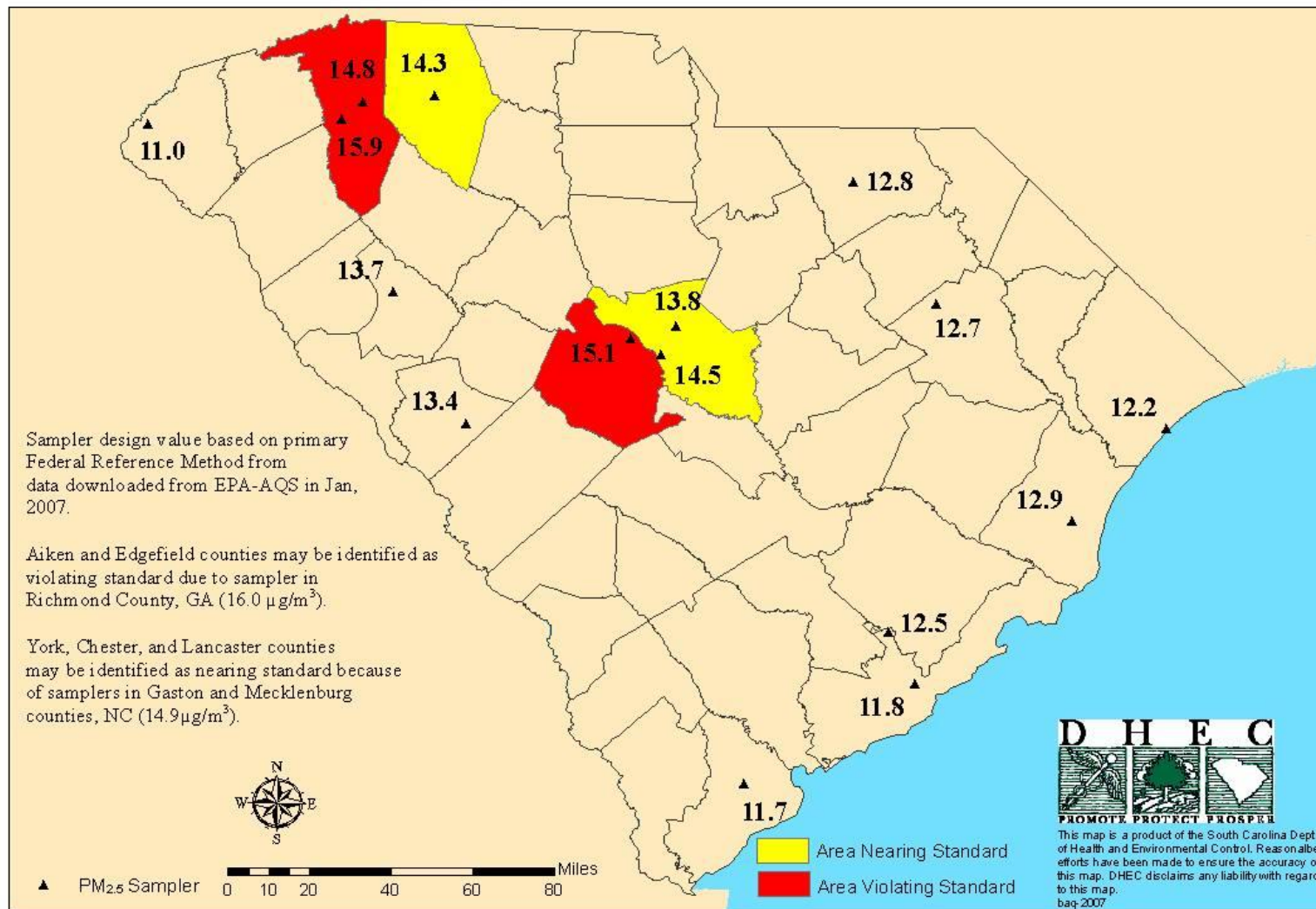
WHAT IS THE PM_{2.5} STANDARD?

- There are two forms of the PM_{2.5} National Ambient Air Quality Standards (NAAQS).
 - The annual standard is set at 15µg/m³ averaged over three years.
 - The daily standard is set at 35µg/m³ (set as the 98th percentile) averaged over three years.



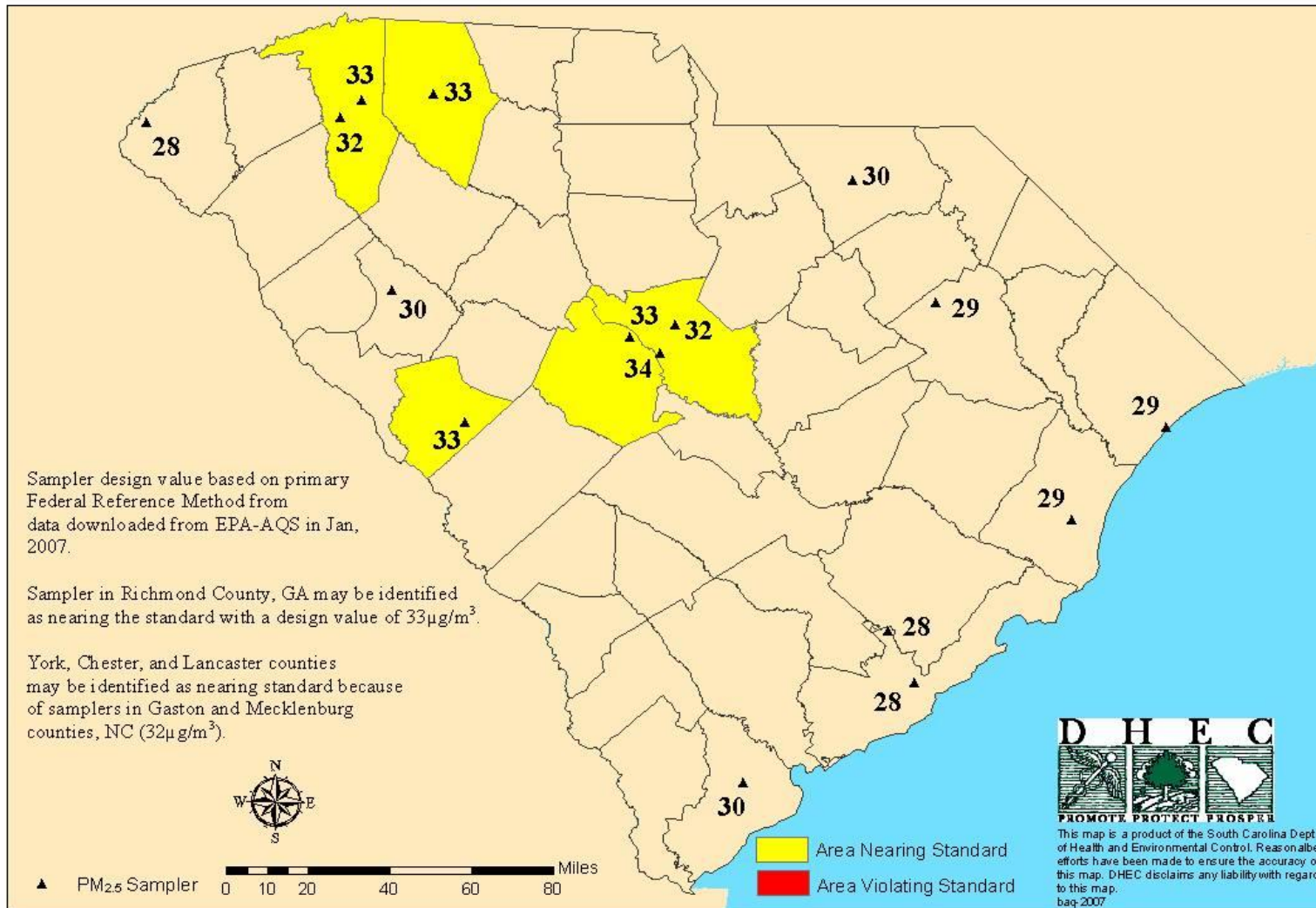
WHAT IS THE CURRENT ANNUAL DESIGN VALUE AT THE IRMO STATION?

South Carolina Counties Violating the Annual PM_{2.5} Standard (2004-2006)



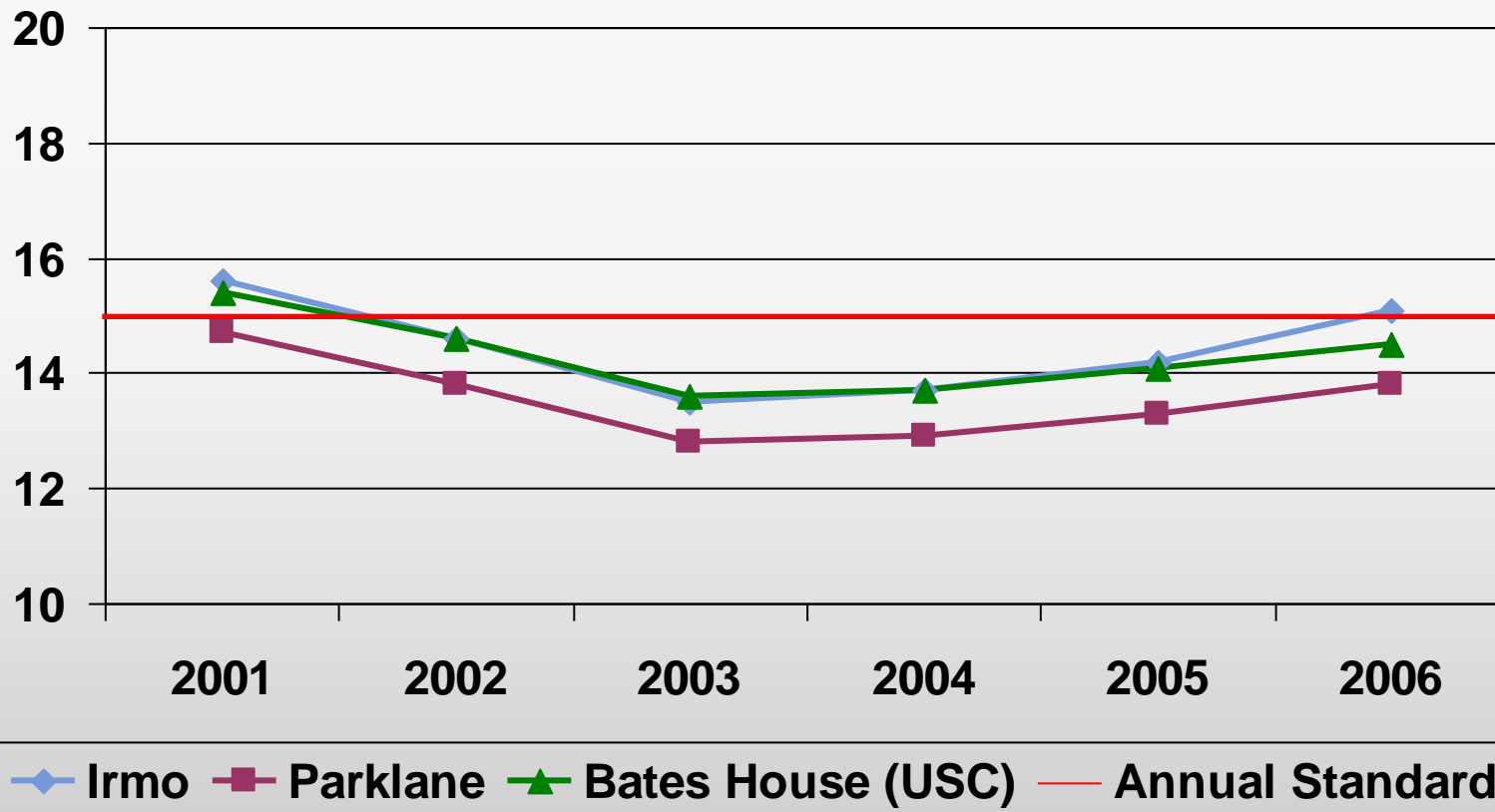
WHAT IS THE CURRENT DAILY DESIGN VALUE AT THE IRMO STATION?

South Carolina Counties Violating the Daily PM_{2.5} Standard (2004-2006)



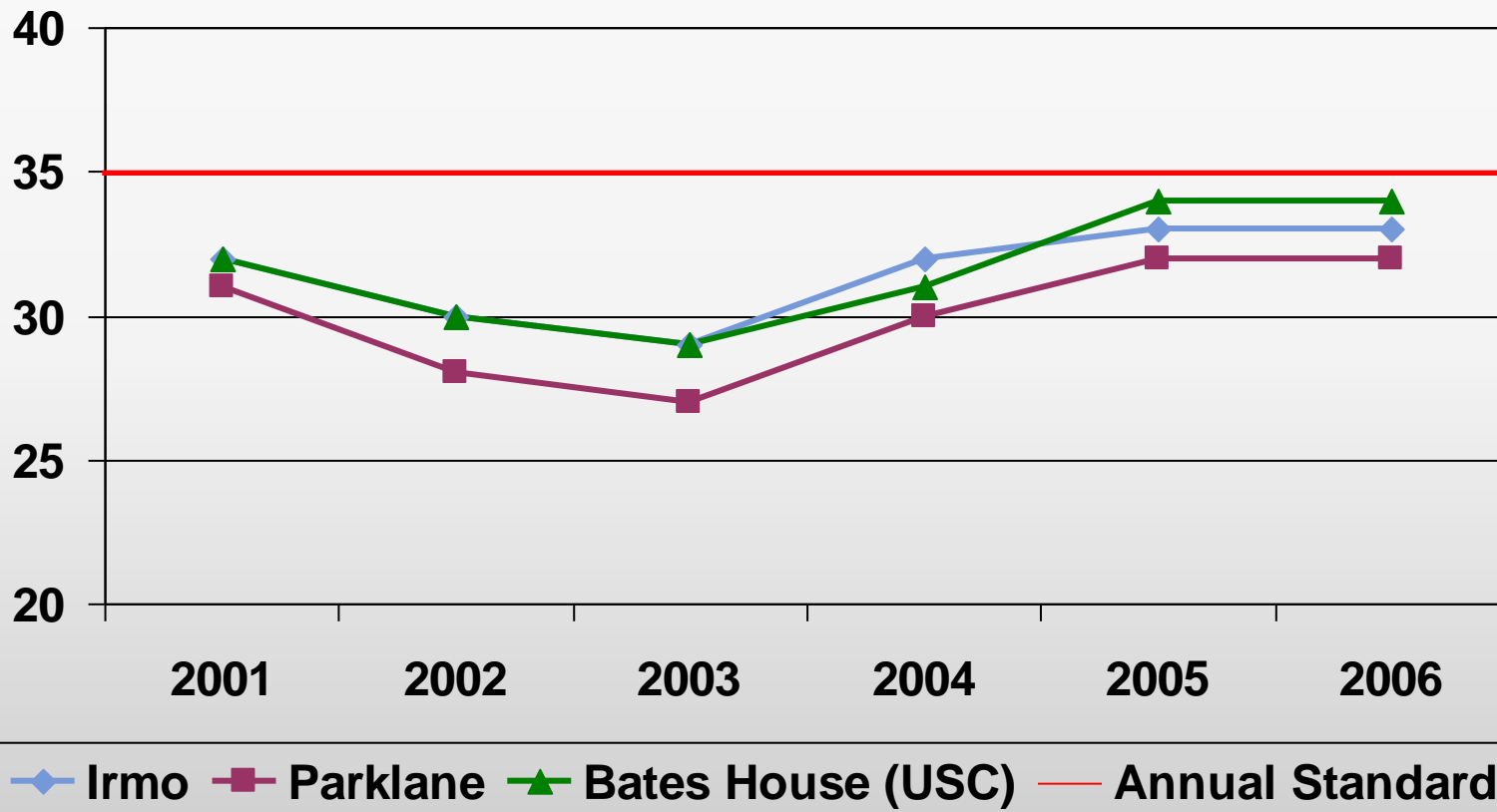
WHAT ARE THE COLUMBIA AREA DESIGN VALUE TRENDS?

Columbia Area Annual Design Values



WHAT ARE THE COLUMBIA AREA DESIGN VALUE TRENDS?

Columbia Area Daily Design Values



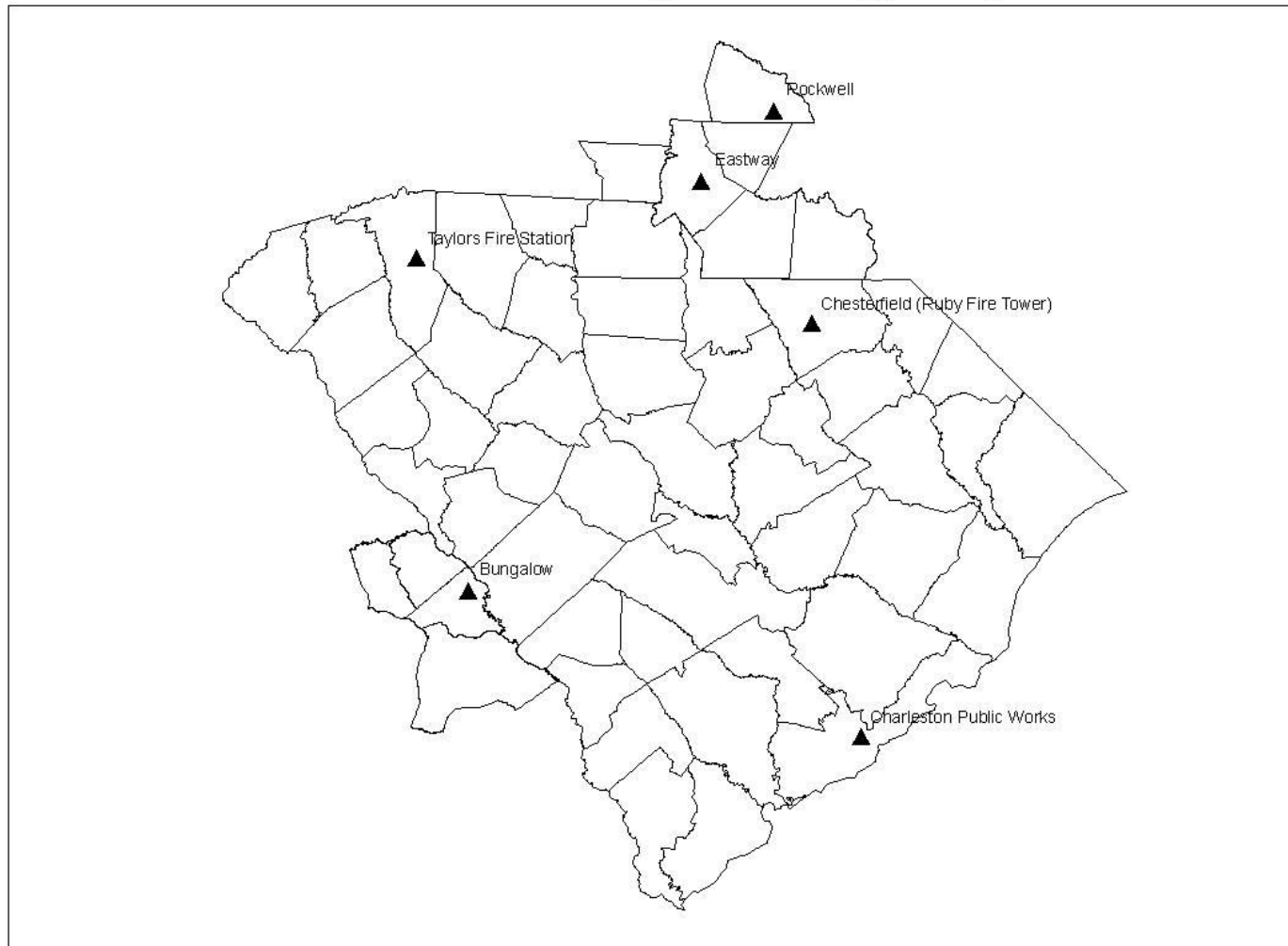
WHY DO SPECIATION SAMPLING?

- Chemical speciation sampling is part of the major monitoring requirements set forth in 40 CFR Part 58, Ambient Air Quality Surveillance for Particulate Matter.
- Data can be used to:
 - Help to implement the $PM_{2.5}$ standard by using speciated data as input to air quality modeling analyses and as indicators to track progress of controls;
 - Aid in the understanding of health studies by linking effects to $PM_{2.5}$ constituents;
 - Understand the effects of atmospheric constituents on visibility impairment; and
 - Use the speciated particulate data to aid in monitoring network design and siting adjustment.



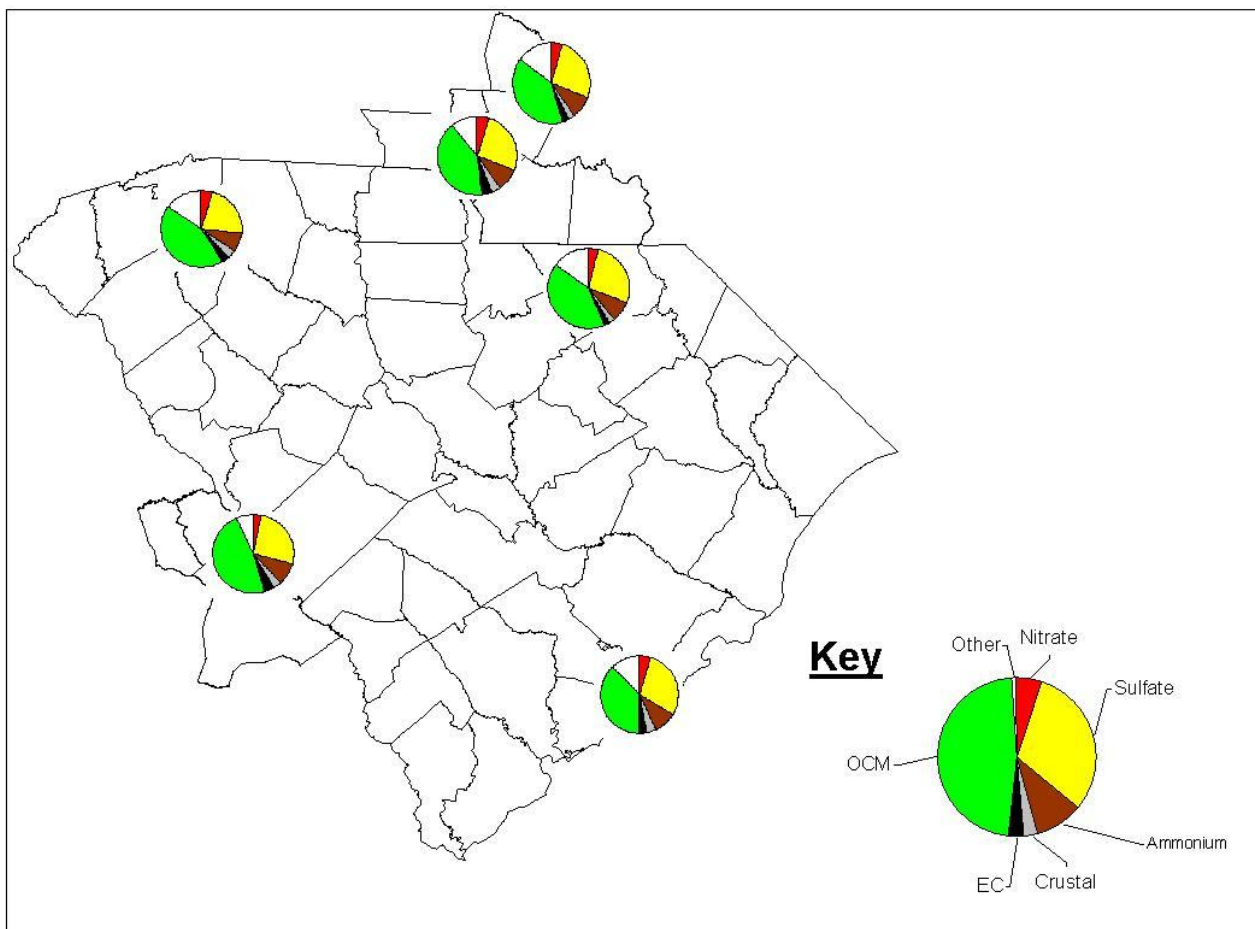
WHERE DOES DHEC CONDUCT SPECIATION SAMPLING?

South Carolina and Surrounding State PM_{2.5} Sampler Locations



WHAT ARE THE MAJOR COMPONENTS OF PM_{2.5} IN SOUTH CAROLINA?

2006 South Carolina and Surrounding State PM_{2.5} Speciation Components

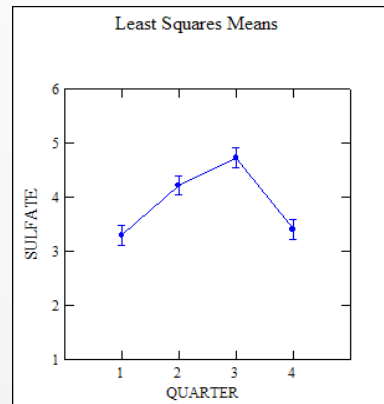
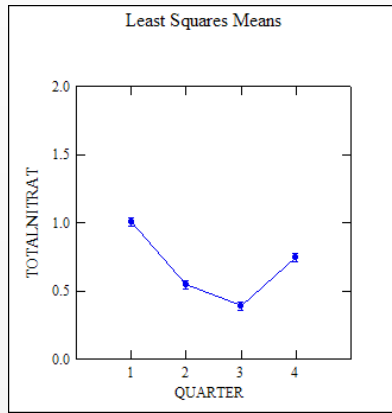


WHERE DO THE MAJOR COMPONENTS OF PM_{2.5} COME FROM?

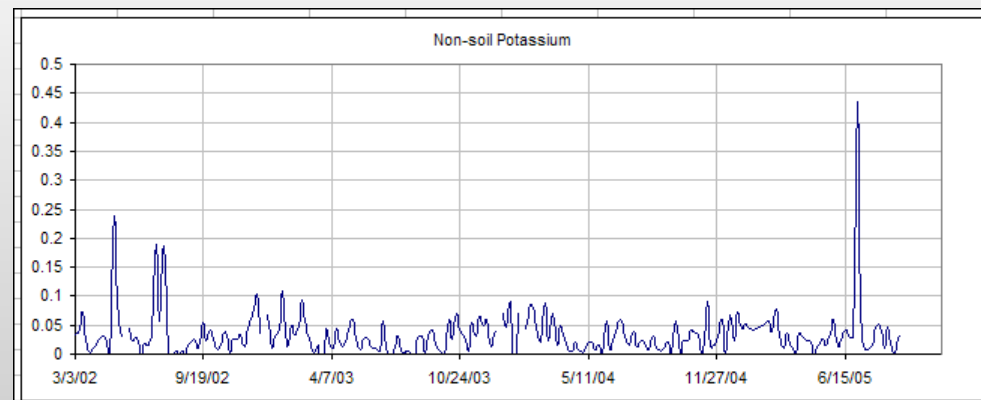
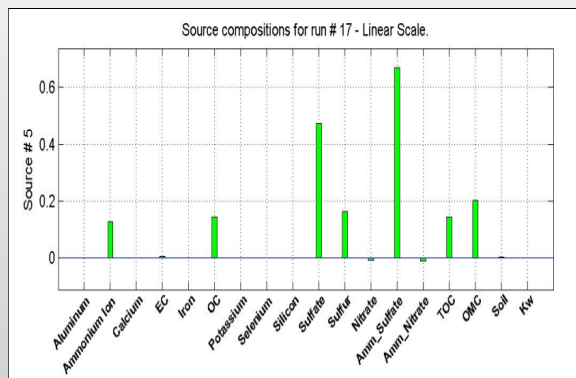
Species	Possible Sources
Sulfate	Fossil fuel combustion
Nitrate	Industrial and automobile emissions, organic decomposition
Organic Mass by Carbon	Biomass burning, automobile emissions, fossil fuel combustion, gas-to-particle conversion of hydrocarbons
Soil	Desert dust, construction, road dust



WHAT CAN BE DONE WITH SPECIATION SAMPLING?



Year	Statistic	Concentrations (µM)						Spec. Mass	PHEC Ratio (µM)	Annual Average	Average of Highest day
		Min	Max	Mean	Std	EC	OCN				
2002	Annual Average	0.7	3.0	1.6	0.8	0.2	0.1	0.1	16.4	142	
	Average of Highest PHEC, max day	0.6	10.8	3.3	0.7	0.5	0.1	3.0	30.1	274	
	Highest PHEC, max day	0.4	8.5	2.8	0.8	0.7	0.2	3.1	30.0	29.9	
	1 st Highest PHEC, max day	0.4	10.8	3.7	1.0	0.4	0.2	3.0	31.2	29.7	
	2 nd Highest PHEC, max day	0.2	11.0	3.3	0.8	0.5	0.0	2.8	29.1	27.9	
	5 th Highest PHEC, max day	1.4	11.6	3.3	0.8	0.6	0.0	3.7	32.1	28.2	
2003	Annual Average	0.9	4.7	1.9	0.4	0.2	0.1	1.2	16.5	150	
	Average of Highest PHEC, max day	0.9	10.2	2.9	0.3	0.5	0.3	9.3	34.6	32.5	
	Highest PHEC, max day	0.6	0.1	0.0	0.3	0.6	15.0	26.7	40.1		
	1 st Highest PHEC, max day	0.3	17.5	4.8	0.2	0.4	0.3	7.3	39.9	36.3	
	2 nd Highest PHEC, max day	0.4	14.0	4.0	0.4	0.4	0.0	10.2	5.1	28.6	23.3
	5 th Highest PHEC, max day	0.2	11.9	2.1	0.2	0.4	0.9	6.2	31.1	21.2	
2004	Annual Average	3.7	1.4	3.2	0.3	0.9	0.7	1.4	24.7	23.9	
	Average of Highest PHEC, max day	0.9	4.5	1.9	0.3	0.5	0.5	1.0	16.3	16.4	
	Highest PHEC, max day	0.6	10.0	3.1	0.3	0.5	0.8	4.2	30.9	28.6	
	1 st Highest PHEC, max day	0.4	12.1	3.7	0.5	0.6	0.4	5.0	32.8	33.0	
	2 nd Highest PHEC, max day	0.5	16.2	4.6	0.3	0.5	0.1	4.5	34.3	32.5	
	5 th Highest PHEC, max day	0.2	12.5	3.3	0.3	0.6	0.0	4.4	30.0	27.5	
2005	Annual Average	1.7	12.4	4.5	0.2	0.5	0.7	2.4	29.9	27.1	
	Average of Highest PHEC, max day	0.4	10.7	2.6	0.3	0.6	0.3	4.2	27.4	27.0	
	Highest PHEC, max day	1.0	4.5	1.9	0.3	0.6	0.7	1.0	16.4	14.3	
	1 st Highest PHEC, max day	0.4	10.6	2.9	0.4	0.5	0.3	4.7	37.8	28.1	
	2 nd Highest PHEC, max day	0.3	9.2	2.7	0.6	0.5	0.0	3.2	26.8	30.0	
	5 th Highest PHEC, max day	0.2	12.5	2.9	0.4	0.2	0.7	5.9	30.1	29.9	
2006	Annual Average	0.2	1.0	2.4	0.6	0.0	0.0	4.2	42.8	20.7	
	Average of Highest PHEC, max day	0.4	11.0	3.5	0.1	0.5	0.2	6.9	28.0	32.1	
	Highest PHEC, max day	0.6	11.1	3.2	0.4	0.6	0.6	3.6	20.2	27.7	
	1 st Highest PHEC, max day	0.0	4.0	1.4	0.6	0.6	0.3	2.7	16.0	14.3	
	2 nd Highest PHEC, max day	0.5	1.0	2.4	0.5	0.1	0.0	4.3	28.1	28.1	
	5 th Highest PHEC, max day	0.2	12.1	3.6	0.5	0.6	0.0	4.5	32.4	35.1	



MAJOR COMPONENT TRENDS

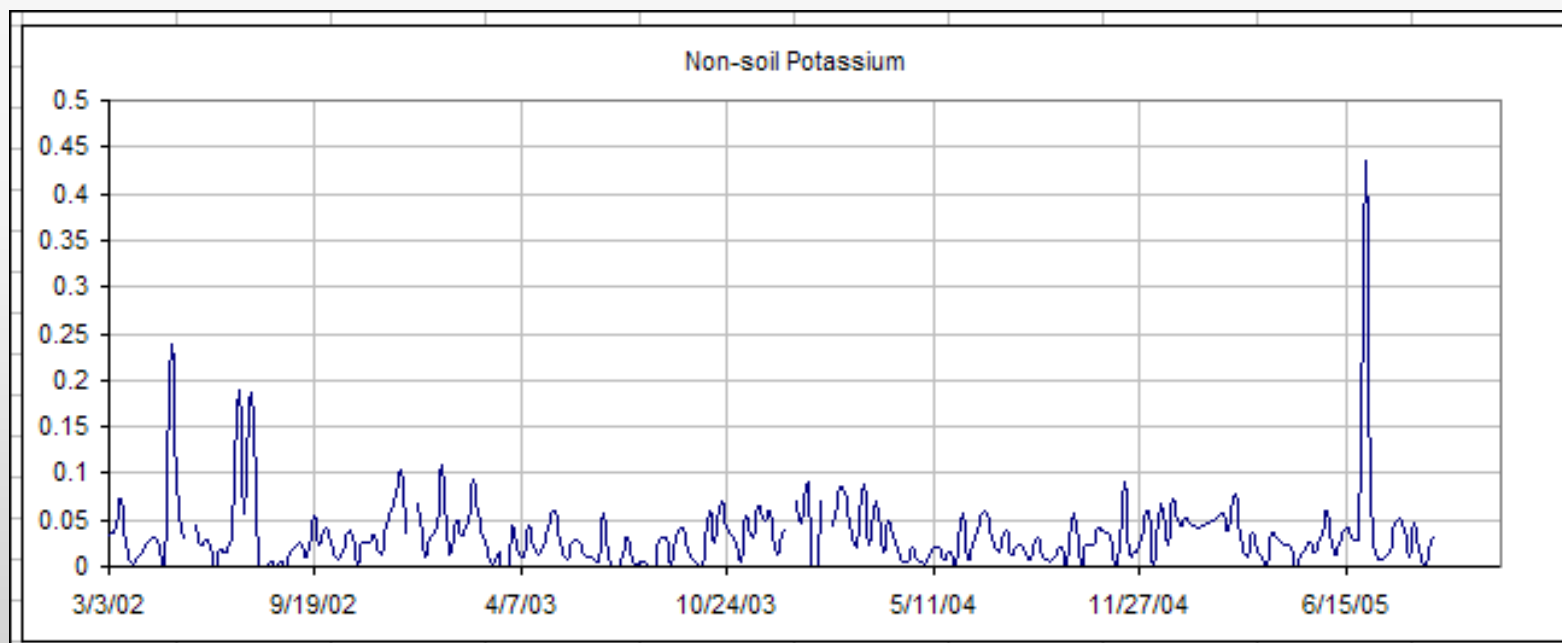
- Can be used to see how the major components of PM_{2.5} vary over time.

Year	Statistic	Composition (µg/m ³)							Spec Mass	PM _{2.5} PM _{Mass} (µg/m ³)	Annual Average	Average of 5 highest days
		Nitrate	Sulfate	Ammonia	Crustal	EC	OCN	Other				
2002	Annual Average	0.9	5.0	1.6	0.5	0.5	7.8	0.1	16.4	14.3		
	Average of 5 highest PM _{2.5} mass days	0.6	10.9	3.3	0.7	0.5	11.1	3.0	30.1	27.6		
	Highest PM _{2.5} mass day	0.4	9.5	2.9	0.8	0.7	12.6	3.1	30.0	29.9		
	2 nd Highest PM _{2.5} mass day	0.4	10.0	3.7	1.0	0.4	13.2	3.0	31.6	29.7		
	3 rd Highest PM _{2.5} mass day	0.3	11.8	3.3	0.5	0.6	10.5	2.9	29.8	27.9		
	4 th Highest PM _{2.5} mass day	1.4	11.6	3.3	0.9	0.6	10.6	3.7	32.1	25.2		
	5 th Highest PM _{2.5} mass day	0.5	11.6	3.2	0.3	0.4	8.7	2.2	26.9	25.2		
2003	Annual Average	0.9	4.7	1.5	0.4	0.5	7.0	1.2	15.8	15.0		
	Average of 5 highest PM _{2.5} mass days	0.9	10.2	2.9	0.3	0.6	10.3	9.3	34.6	32.5		
	Highest PM _{2.5} mass day	0.0	0.1	0.0	0.3	0.6	15.0	26.7	42.6	40.1		
	2 nd Highest PM _{2.5} mass day	0.3	17.5	4.5	0.2	0.4	8.8	7.3	38.9	36.8		
	3 rd Highest PM _{2.5} mass day	0.4	14.8	4.0	0.4	0.6	10.2	5.1	35.6	33.8		
	4 th Highest PM _{2.5} mass day	0.3	11.9	3.1	0.2	0.4	8.9	6.2	31.1	28.2		
	5 th Highest PM _{2.5} mass day	3.7	6.6	3.2	0.3	0.9	8.7	1.4	24.7	23.5		
2004	Annual Average	0.9	4.6	1.5	0.3	0.5	6.9	1.0	15.8	14.4		
	Average of 5 highest PM _{2.5} mass days	0.6	13.0	3.8	0.3	0.5	8.5	4.2	30.9	29.4		
	Highest PM _{2.5} mass day	0.4	13.1	3.7	0.5	0.6	9.4	5.0	32.8	33.0		
	2 nd Highest PM _{2.5} mass day	0.5	16.2	4.6	0.3	0.5	8.1	4.5	34.8	32.5		
	3 rd Highest PM _{2.5} mass day	0.2	12.5	3.3	0.3	0.6	8.8	4.4	30.0	27.5		
	4 th Highest PM _{2.5} mass day	1.7	12.4	4.5	0.2	0.5	7.7	2.6	29.5	27.1		
	5 th Highest PM _{2.5} mass day	0.4	10.7	2.8	0.3	0.6	8.3	4.2	27.4	27.0		
2005	Annual Average	1.0	4.5	1.5	0.3	0.6	7.4	1.0	16.4	14.8		
	Average of 5 highest PM _{2.5} mass days	0.4	10.4	2.9	0.4	0.5	8.3	4.7	27.5	28.6		
	Highest PM _{2.5} mass day	0.3	9.2	2.7	0.6	0.5	10.0	3.2	26.5	30.0		
	2 nd Highest PM _{2.5} mass day	0.2	12.5	2.9	0.4	0.2	8.7	5.9	30.8	28.9		
	3 rd Highest PM _{2.5} mass day	0.2	8.0	2.4	0.6	0.5	7.0	4.2	22.8	28.7		
	4 th Highest PM _{2.5} mass day	0.4	11.0	3.2	0.1	0.3	7.2	6.8	29.0	27.8		
	5 th Highest PM _{2.5} mass day	0.6	11.1	3.2	0.4	0.8	8.6	3.5	28.2	27.7		
2006	Annual Average	0.8	4.0	1.4	0.6	0.6	7.8	2.7	18.0	14.3		
	Average of 5 highest PM _{2.5} mass days	0.5	9.0	2.9	0.5	0.7	10.8	4.3	28.8	29.1		
	Highest PM _{2.5} mass day	0.3	12.1	3.6	0.5	0.6	11.0	4.5	32.6	35.1		
	2 nd Highest PM _{2.5} mass day	1.1	6.3	2.5	0.3	1.1	11.3	-1.3	21.3	28.3		
	3 rd Highest PM _{2.5} mass day	0.2	8.7	2.9	0.6	0.6	10.0	9.0	32.1	27.5		
	4 th Highest PM _{2.5} mass day	0.4	8.8	3.2	0.4	0.6	12.3	5.0	30.6	27.4		
	5 th Highest PM _{2.5} mass day	0.5	9.3	2.5	0.6	0.7	9.3	4.4	27.3	27.4		



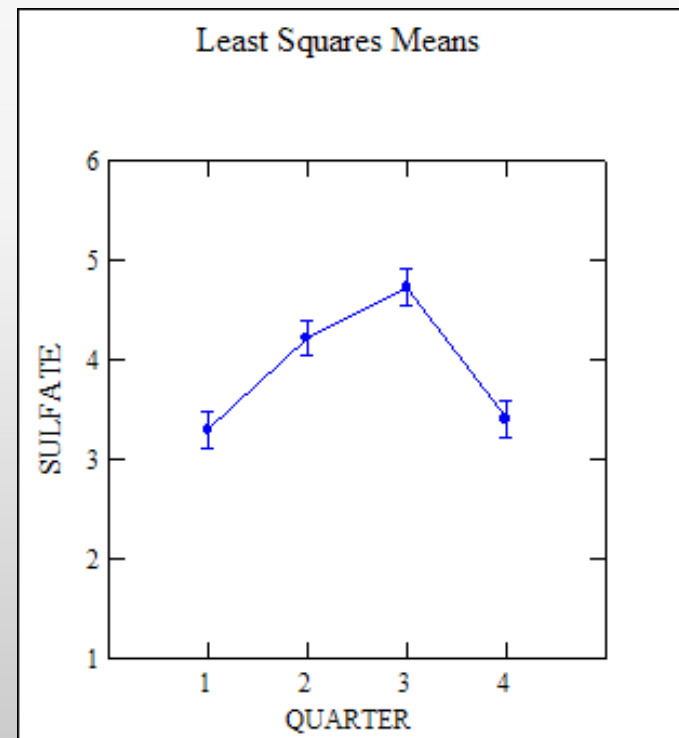
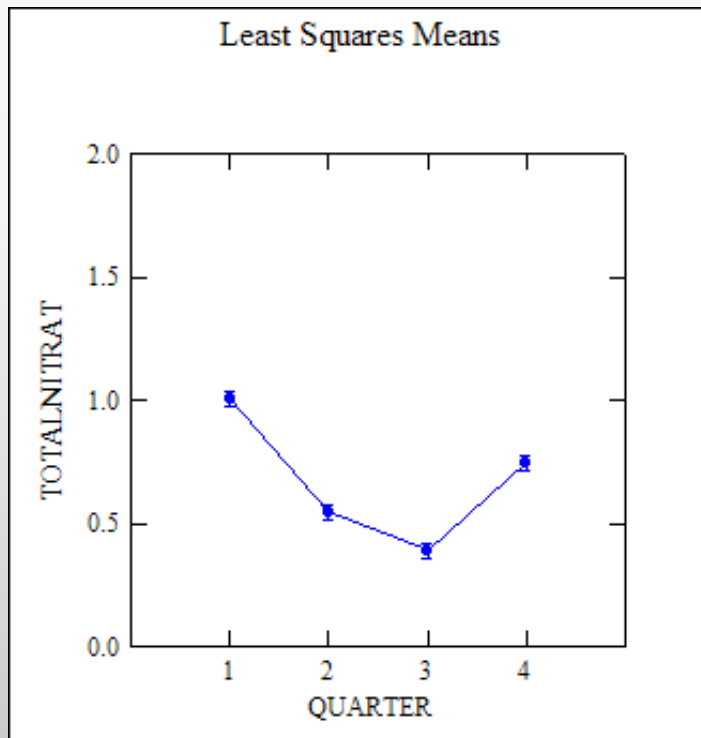
EXCEPTIONAL EVENT DETECTION

- Time-series plots can be used to detect one time events that affect air quality.
 - In the plot below, potassium spikes on July 3rd. This event may be related to fireworks.



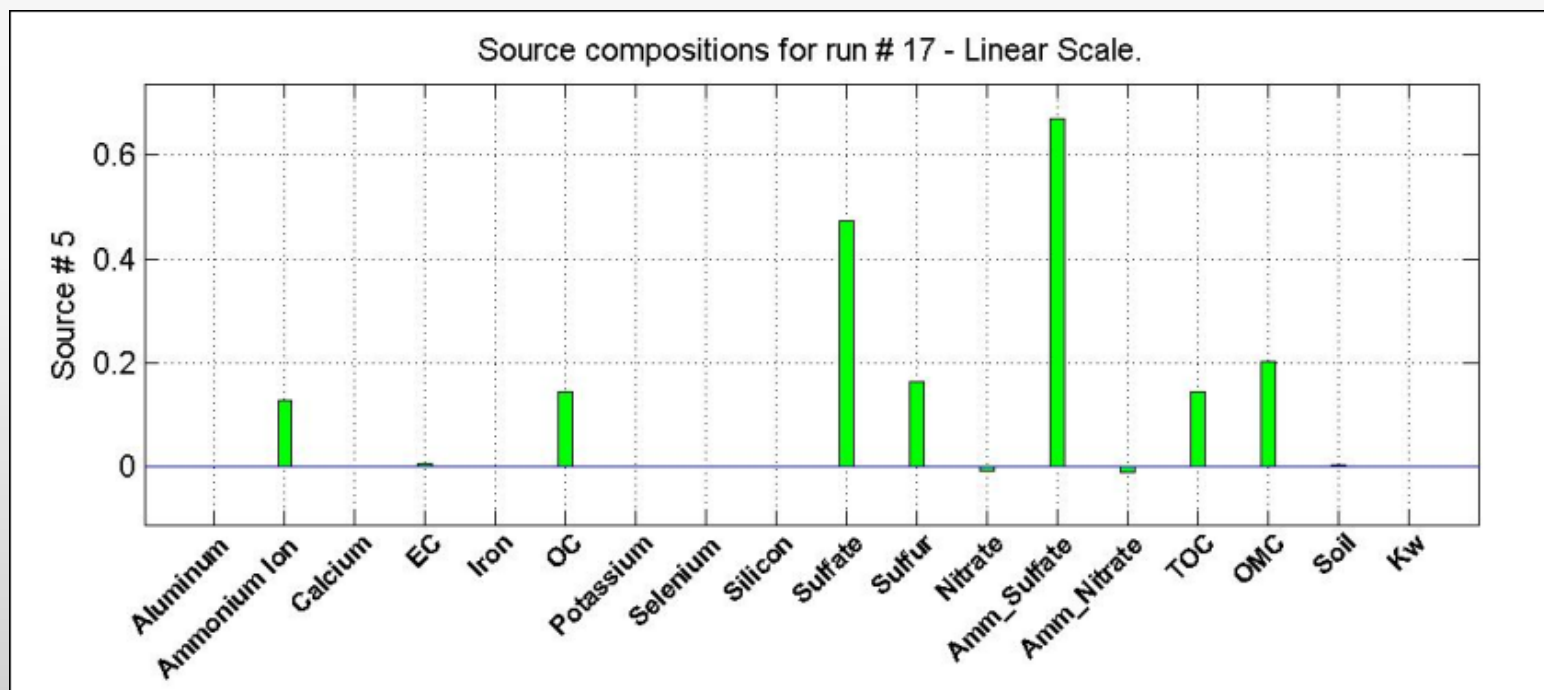
TREND ANALYSIS

- Speciation data can be used to determine when the highest concentrations of a component occur.
 - In the examples below, nitrate has a high average concentration during the winter months. Sulfate has a high average concentration during the summer months.



SOURCE APPORTIONMENT STUDIES

- Speciation data can be used to identify contributing source types.
 - In this example, a sulfate signal is detected through a source apportionment model.



WHAT ARE THE POSSIBLE SOURCES OF $PM_{2.5}$ AT THE IRMO SAMPLING STATION?

- In ambient monitoring, the sources could be numerous.
 - Examples of sources of $PM_{2.5}$ could be point sources, area sources, automobiles, open burning, etc.
 - Without speciation sampling a definitive answer is hard to make.



IS SPECIATION SAMPLING COMING TO IRMO?



Questions?

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